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A
SHORT SPECIMEN
OF A
New Political Arithmetic;
CONTAINING,
SOME CONSIDERATIONS
Concerning
Public R O A D S.

By a FELLOW of the ROYAL SOCIETY.



16.

L O N D O N :

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ADVERTISEMENT.



T this Season of the Year, most People by whom such a Treatise as this will be Read, are hastening into the Country ; and it is there Only, that it can be Read to any useful Purpose.

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For

iv *Advertisement:*

For this Reason I now publish it, that GENTLEMEN who Delight in such Speculations, of whom *England* may boast of a greater Number than all the World besides, might provide themselves with a Companion to afford them some useful as well as curious Entertainment, during their Recess in the Summer ; and furnish them Matter for very uncommon Reflections, while they are on the Road to and from their Country Seats.

Even they who are most conversant in *Political Arithmetic*,
and

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and have Read all that has been published in any Language, in that Way, will find the Method I here make use of, altogether New; and to me the Subject is likewise New. I know of nothing that has been hitherto Written to recommend the Paving any great Road in this Kingdom; and I have Vanity enough to believe, that no Treatise of that kind, could have been of much Service to me, in the Manner in which I have considered great Roads.

If

vi *Advertisement.*

If what I now offer to the Public shall so far meet with a favourable Reception, as that I can judge my Way of Reasoning on *Political Subjects* likely to be of any real Use ; I shall most willingly go on to imploy it, about other Things of much greater Consequence than what I now venture to give as a Specimen. Till then I hope my READERS will excuse my desiring them to take several Things for granted, on which both my Computations and Conclusions depend. I dare Promise all who shall think such Discussions worth

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worth entering into, that they shall see whatever looks like *Postulata* in the following *Discourse*, fully made out from Principles that are *True* and *Solid*, not only at this Time, but which must remain so to be, as long as Men and all useful Animals, and the Earth it self which they Inhabit, shall continue the same with what they are at present, and have always been.

May 1st.
1734.



SOME
CONSIDERATIONS
CONCERNING
Public ROADS.

I. ONDON, the Metropolis
of powerful and wealthy
Britain, has this in com-
mon with the Capitals of
all other Nations, that, being the
chief Seat of GOVERNMENT, the Foun-
tain of Law and Justice, and the
Center of Pleasure, Learning and Po-
liteness; both the Busy and Pleasura-
ble Part of the Inhabitants of our Isle,
must be continually resorting to it :
And there will be very few found, that
Fortune has placed above the Necessity
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of Day-labouring, whom either their Inclinations or Affairs do not require to make frequent Visits to this great City. It is no Wonder therefore, if in every Session of Parliament, we find Bills brought into the House of Commons, for repairing the High-Ways, especially such as lead directly to *London*; the Safety and Conveniency of Travelling being every Way worthy the Care and Attention of that great Council of the Nation.

II. If to the Pleasure of Travelling we add the Consideration of the Carriage of all kinds of Goods, the Necessity of a very particular Concern about the great Roads of the Kingdom, will still further appear.

That there are within the Bills of Mortality of *London*, never less than a Million of Souls, taking the whole Year round at a Medium, is an Assertion that may be demonstrated to be sufficiently within Bounds: And it is equally true, that notwithstanding the great Conveniency of

of the *Thames*, a large Part of all our Necessaries both for Life and Luxury, as far as this Kingdom can supply them, are brought us from the Country by Land-Carriage.

Again, as *London* is the chief Seat of Government, so it is the chief Seat of Trade. From this City is exported the far greatest Part of the Goods which all *England* furnishes to Foreign Nations: And these, either in the same State in which they are exported, or the Materials of them, must likewise come by Land-Carriage.

III. It is needless to insist further on this Head: The necessity and importance of taking care of the Public Roads, is past Dispute with all the World; and therefore the general Propositions, in which I have express'd what relates to those that lead to *London*, is sufficient for my present Purpose, without any more particular Explication.

Were such an Explication necessary on this Occasion, the Effects of each

particular abovementioned, on the High-Roads, or of the High-Roads on them, might be determined to a surprizing exactness, from Principles founded on Observation and Experience, by a Method every way as certain, Regard being had to the nature of the Subject, as that used by Mathematicians, in the Application of the Modern Analysis to Natural Philosophy.

I shall perhaps, sometime or other, find an Opportunity of explaining at full length, wherein that Method consists; and of shewing to what a prodigious degree, a diligent Inquirer, by pursuing it to a due extent, may carry the political Knowledge of any Kingdom, and the true secret of raising it to the greatest height of Wealth and Power; of Honour and Happiness; as far as these depend on promoting Home and Foreign Trade, in imploying all the Land, and the Labour of all the Inhabitants to the best Advantage, and in disposing and managing the general Stock of the Nation in such a manner, as that every

every new Accession may be turned to the greatest Benefit of the whole, with the least mixture possible of those Evils, which commonly attend a thriving State.

IV. To return from this short Digression : I believe it will be found that notwithstanding the Provisions made from time to time for the High-Roads, and the general Sense of the Nation concerning the Necessity of keeping them in good Order, the greatest part of them are in a very bad State ; and among these, some of the most frequented in the whole Kingdom : And that they are likely to continue so, till some new Methods are fallen upon to prevent it.

Whether any Proposal has been ever set on Foot for paving or Caulf-waying any of the great Roads of *England*, I know not ; nor have I ever heard for what Reasons, such Proposals, if ever made, have been laid aside : But to me it seems evident, from constant experience, that with-
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out a Causeway, all attempts to make the Roads between *London* and *Bristol*, *York*, and many other Principal Towns, such as they ought to be, or even to answer in any tolerable Manner, the Expences bestowed on them, must be always fruitless, that is, must require more Labour and Charge to be laid out, in the compass of a very few Years, and all to no Purpose, than that of Paving them would amount to.

V. All Objections that can be raised against such an Undertaking, are of these two kinds; such as may be drawn from the Nature of the Undertaking, or from the Interest that any particular set of Men may have in opposing it. These last, I am not at all concerned in, neither do I pretend to answer them any more than I can tell, why after all the laudable Endeavours that have been used, Public Registers are not universally established in *England* for enrolling all Conveyances, and other Contracts of that kind; which

which are found to be of the greatest Benefit in Countries where they have place: Why we are not allowed the use of Wind-mills for sawing of Timber, which would save the Nation a great Part both of the Money we pay the *Dutch* for Deal-Boards, and of the Labour of our own People spent in sawing with the Hand: Or, why such extravagant Sums are gather'd every Year for the Poor, when less than the Collections of one Year employed properly in setting the Poor to Work, would free the Kingdom from that Expence for ever after.

VI. The Objections which arise from the nature of the Undertaking, are in general the great Charge of making Pavements, and the difficulty there would be to find Stones in many Places of *England*, thro' which such Pavements must pass, if any were to be made.

I only mention this last Objection, because I have heard it rais'd; for in reality there is nothing in it. There
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are very few Places in *England*, where Stones proper enough for Pavements, may not be had, without being brought from any extraordinary Distance: And it is now well known, that in Case no such Stones could be had, there is a method lately Discovered, of making Bricks of a certain Composition, which costing but a very little more than the common sort, may be baked to such a degree of solidity and compactness, as to hold out many Years, under the greatest Weights that are allowed to be carried on any paved Road now in being, which is managed as it ought to be.

VII. The excessive Charge of making a Causeway of any considerable length, is an Objection that will appear to be of great Weight with most People: And I am apt to think, that it has been chiefly on this Account that Causeways have not hitherto been brought in Fashion in *England*.

To

To answer this Objection, is the principal design of this short Essay; and that I may do it to purpose, I must begin by examining what the real Charge of a Pavement of any given Length, amounts to. This I have had as good Opportunities of doing, as can be desired, during a long stay in the Low Countries, especially in *Flanders* and *Brabant*. I perused the Contract between the States of *Flanders*, and the Undertakers of the Causeway between *Ghent* and *Courtray*; I saw a large Part of that Causeway laid, as also of that between *Brussels* and *Namur*, and had full time to inform myself of the Workmen, concerning every thing that belongs to the Labour and Expence.

From all these Observations, the following Computation is form'd; and that the Numbers may not swell to any unnecessary length, I shall confine it to a League of High-way, that is, to Three thousand Geometrical

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Paces,

Paces, or Fifteen thousand Feet, of twelve Inches each.

VIII. That a Pavement may answer all uses to the best Advantage, it ought to be twenty Feet broad ; there ought to be a Road of ten Feet on each side of it ; and these Roads should be border'd by a Ditch a Foot broad, for draining the Water.

IX. The first Labour about a Pavement, is that of making the *Lit*, or Bed in which it is to be laid, which according to the Demenſions here ſtated, muſt be Forty two Feet in breath ; and in a Country which is not very uneven and where it is not required, that a Pavement be exactly level, the Bed taken altogether needs not to be above three Feet deep.

Two Men, whereof one digs and fills the Wheel-barrows, the Other carries away the Earth and throws it upon the Sides of the Bed, can make ſeven Feet in length, in a Day : So that, by
reducing

(II)

reducing this whole La- Days of One
bour to Days Work of Man. Horse.
one Person ; making the
Bed, amounts to - - - 4286

X. In laying the Cauf-
way, which is the next
Labour, two Men fix the
Stones, one Man makes
the Borders, and two
Men serve the three for-
mer with Stones, Earth,
Sand, &c.

Five Men thus im-
ploy'd can Pave thirty
Feet in a Day ; which
reduced to Days Work of
one Person, as before,
makes - - - - - 2500

XI. The Roads on
each Side the Pavement,
are made by throwing
the Earth from the Sides
of the Bed, and then

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level.

levelling and ordering it according to the Height and Breadth required.

Days of One
Man. Horse.
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Two Men thus employed can do thirty Feet on each Side in a Day, which for the Whole amounts to - - - - -

1000

In making these Roads, the Labour of making the Ditches is included.

XII. After the first four Years, if a Pavement is kept under proper Regulations, very few Repairs will be necessary for several Ages. During that Time, the Stones not having intirely taken Root; and not being thoroughly cemented ; some of them are apt to loosen, especially after great Frosts ; and consequently fre-

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quent Repairs are necessary. But as these are purely accidental, and it is impossible to determine by any fix'd Rules, what they amount to. All we can do in this Case, is to be guided by the Observations of experienced Workmen, according to which, a Day's Work of one Man may be allowed, during each of the four Years, for every twenty Feet, which in all makes - - - - -

Days of One
Man. Horse.

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3000

XIII. The only Materials here made Use of, are Earth, Stones, and Sand. All the Earth required, is taken out of the Bed, and therefore, no new Labour is to be added about that. The

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Sand

Sand is commonly found without much Difficulty, and therefore, the Labour of digging it needs not be separated from that of filling the Carts. Three Carts of Sand drawn by two Horses, will be necessary for every twenty Feet of Pavement, which for the Whole amounts to Two thousand, two hundred and fifty Cart Loads. All this Sand may be supposed to be found within a Quarter of a League of the Pavement; and therefore, allowing a Man to each Cart, and that they make eight turns in a Day, the Carriage of the whole Sand will make - - - - -

Days of One
Man. Horse.

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282 564

11068 564

XIV. Every

XIV. Every five Feet of Pavement requires 2 Cart Loads of Stones, drawn by two Horses; and a League requires Six thousand such Loads. Of such Stones a Man may dig three Loads in a Day out of the Quarry, with all the Precautions necessary to be observed about Stones fit for Pavements, which for the Whole amounts to - - - - - 2000

I shall suppose these Stones to be carried a League and an Half; which I hope will be reckon'd a sufficient Distance; and at this Rate, each Cart may make two Turns *per Diem*; and the Carriage of all the Stones amounts to - - - - - 3000 6000

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XV. No

XV. No Part of the Labour about a Pavement, seems to be here omitted ; and therefore, the whole Charge of making a League amounts to Sixteen thousand and sixty eight Days Work of one Man ; and to Six thousand, five hundred and sixty four Days Work of one Horse, that is to the Labour of something less than Fifty three Men and Twenty two Horses for a Year. I here suppose the Year to consist of Three hundred Days, which is nearly the Number of Working Days in *England*, and in other Protestant Countries, Sixty five only being deducted for *Sundays* and *Holidays*. But in *Roman Catholic* Countries, an Hundred Days are the least Allowance that can be made in Computations of yearly Labour ; by which it appears how prejudicial that Religion is to the Temporal Interest of the Kingdoms where it prevails ; for very near Two seventh Parts of the whole Labour of the People are lost ; and almost a Tenth Part more than in Protestant Countries ; so that
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meerly on Account of Labour, Nine Protestants are to be esteemed worth Ten Roman Catholics.

XVI. The Reduction of the Labour here considered, to that of one Year, makes it easy to find its Value in Land; and thereby, to compare it with Labour of any other Kind, which can by no means be done so justly as by reducing them both to this common Measure. In this Comparifon, however, it is not necessary to lead the Reader into any nice Application of that curious Problem concerning the Equation of Land and Labour, deservedly called by Sir *William Petty*, the most important Consideration in Political Arithmetic; but which, as far as can be gathered from what he has said about it, he seems no ways to have understood.

It is sufficient for my present purpose to take Notice, That from Calculations founded on very compleat and accurate Observations, it may be made appear, that three Acres of Ground are more than sufficient to supply any one

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Person

Person whose Labour I have here considered, with Food, Cloths, Lodging, and all the other Necessaries of Life, in the same Plenty, or rather Petty-luxury, in which we observe them to be enjoyed by such People in *England*: And *secondly*, if we pitch on any determined Number of such People, one third Part of that Number, can perform all the Labour of every kind, both for themselves and the other two Thirds.

We have already found one Year's Labour of Fifty three Men, to whom if Twenty seven be added, to furnish these and themselves with all Necessaries, as far as they depend on Labour, the whole Number of Eighty will require one Year's produce of Two hundred and forty Acres of Ground.

Again, a Working Horse, besides the Straw, &c. which the Land already computed, furnishes him with, must have about two Acres, for Oats, Hay, &c. Therefore, Twenty two Horses make an addition of Forty four Acres, which Number must still be increased

creased by Twenty nine Acres, to maintain, first, ten Horses for Manuring all the Land for the Men, the other Horses and themselves ; and likewise three Men whose Labour is required about the Horses and themselves, besides that already considered. All these Sums being collected ; the Charge of making a League of Pavement will be found to amount to one Year's produce of Three hundred and thirteen Acres of Ground.

XVII. It may perhaps be said, that to this ought to be added, not only a Yearly but constant Expence of some Land taken up by this new Road, more than before it was paved ; there being few unpaved Roads in any good Land, that are suffered to run to the Breadth of Forty two Feet. In answer to this, it is to be considered, that in most Pavements that I have seen made, a double Row of Trees is planted with the same Labour which is imploy'd about the Roads, on each side the Pavement ; and these will more than Ba-

lance any supposed addition of new Ground.

To explain this a little : The Pavement which I have consider'd, being Fifteen thousand Feet long, and Forty two Feet broad, consists of Six hundred and thirty thousand square Feet, or nearly of Sixteen Acres, allowing Forty thousand square Feet to an Acre. Supposing the Trees at ten Feet distance from one another, Three thousand may be planted on both sides of the Road, which are equal to the constant produce of seven Acres and an half, bearing tall Trees. As Trees cannot be so conveniently planted in Roads that are not paved, nor with so little Labour, and since in every Country, Ground must be allowed for Wood ; these seven Acres and an half are to be deducted from the Sixteen taken up by the League of Road, so that eight Acres and an Half only will remain, which is the Ground taken up by a Road of the same Length, and between Twenty two and Twenty three Feet in Breadth. This Breadth is less
than

than that of any of the great Roads of *England*.

XVIII. The Charge here computed is undoubtedly very great; but on the other Hand, I hope, that none who seriously consider the Computation I have made of all the Parts of it, will think that either there is any material Part omitted, or that I have not stated each Article at its full extent. The Carts, Hammers, Rammers, Crows and other Instruments of Labour, both of Wood and Iron, ought, it is true, to have been taken in, if my Design had been only to compute the Charge of Pavements without any farther View; but since the chief Use I am to make of this Computation, is to compare paved Roads with those that are not paved, I shall have Room to make an Allowance, in considering these latter, which will much more than Balance what I have here, to avoid an unnecessary Length, ventured to pass over.

XIX. It

XIX. It is past Dispute, That by paving any great Road in the Manner already said ; the Communication between all Places through which it passes, or which lie near it, is very much improved, and except where natural Causes not to be guarded against by any human Fore-sight, intervene, reduced to an Equality, all the Year round : Many Accidents dangerous both for Men, Horses and Goods, in bad Roads, especially during the Winter Season, are intirely prevented ; Travelling, whether on Foot, Horses, or in Carriages, rendered as easy, pleasant, safe and expeditious, as it possibly can be by Land. These and many other Advantages, especially in Roads that lead directly to *London*, every one must perceive to be very great, and that by them alone, the Charge of making a Pavement would soon be made up to the Nation.

It would certainly be a very useful as well as curious Speculation, to make a particular Estimate of each of these

these Advantages, and to determine by Computation, how far precisely every Branch of these which I have mention'd, and of others that might be added, would be carried, by making a Pavement between any two given Places ; and as the result of such a Computation might very fitly be express'd in Land, by means of the Problem already mentioned, concerning the Equation of Land and Labour ; and thus be compared with the Charge of the Pavement ; it would then appear, that in a very short Time, that Charge would be compensated, and consequently what a yearly Advantage that Pavement would be to the Country for ever after.

This, however difficult it may appear, and out of the common Road of Inquiries in Political Arithmetic, is very far from being impossible to be done, from Observations either already made, or which, with Relation to any particular Place, may be carried to such an exactness, as that the Computations formed upon them, shall be so far

far without any material Mistake, when applied to the real Existence of Things, that the Conclusions drawn from these Computations, shall differ from the Truth, only by a Quantity as small as any one pleases to imagine.

But the Prosecution of this curious and uncommon Subject, would necessarily lead me to enter into the Detail of Domestic Trade ; and indeed, of the whole Practice of Society, that is, of the Manner in which Society, however formed at First, is now carried on, and wherein that constant Intercourse consists in all its particular Branches, which we observe the Inhabitants of any one Country or Part of a Country, to maintain with one another. The Use I could make of so nice an Inquiry in this Place, would hardly answer the Pains I must be at, to set it in a due Light, and therefore, I shall reserve it for some more important Occasion.

XX. At present I chuse to confine the Comparison of paved and unpaved Roads to Carriages only, such as we see
 . them

them actually performed in Countries, where there is not the tenth Part of the Trade which *England* is Mistress of.

By bringing this Comparison within so narrow a Compass, it is evident, I lose the far greatest Part of the Advantage I might have made of it, when considered in its full Latitude; but it will soon be made Plain, that even the small Part which I have reserved, the Consideration of Carriages alone, will set this publick Undertaking of paving some of the great Roads of *England*, at least on a Level with any that we find either actually encouraged, or from Time to Time pressed upon the Nation with all the Advantages of Eloquence and Address.

XXI. Whether we consider the Regulations made by the Magistrate, concerning the weight of Goods that may be carried in one Waggon on a Pavement, or the common Practice all over the Low Countries; the following

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lowing particulars, to make the computation easy and simple, may with certainty enough be taken for granted.

1. All Carriages may be reduced to Waggon drawn by three Horses with one Man to attend each.

2. On each Waggon may be loaded six Thousand weight of Goods.

3. The Horses may work every working Day in the Year; and time enough being allowed them to rest and feed, they can go ten Leagues in twenty four Hours.

4. Before Horses are fit to draw constantly in a Waggon, they ought to be five Years old. But, as from the Age of three Years, they are capable of doing easier Work, in which Horses above five Years must otherwise be employed, if when under that Age, they did no Work at all; in a Computation of the whole Labour of Horses, it amounts to the same thing with respect to all the working Horses in any particular Country, to make the
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the Waggon Horses begin to draw at the Age of three Years, instead of five.

5. Horses that draw constantly on a Pavement being liable to very few Accidents, may one with another, be supposed fit for Work till the Age of fifteen Years compleat; they that are able to Work after that Age, being sufficient to make up for the Loss of those that die before, by any Accident whatever.

Whoever shall have an Opportunity of examining the Carriages upon Pavements in the *Netherlands*, and the Method of Working Horses there, will find all these Particulars sufficiently True, that is (which must always be understood of Observations made concerning Things that admit of considerable Varieties) that they are an exact Medium chosen, according to the Rules of Art, from all the different Observations which a diligent and faithful Inquirer will find it necessary to make.

XXII. The Carriages upon unpaved Roads cannot so easily be determined by any general Methods. The Nature of the Soil, the Difference of the Weather, the Seasons of the Year and several other Causes, produce in them Varieties that are almost infinite.

Among a great many such Roads, that I have made Inquiries about in *Flanders*, I found that the Road from *Lisle* to *Arras*, is not only one of the best in the whole Country, being passable all the Year round, which few of the rest are for any considerable Length together, but even fully as good as any great Road in *England*, where a Pavement would be thought necessary.

As my Observations on Pavements were mostly made in that Country, the unpaved Roads must be chosen there likewise, to make the Comparison of the two Kinds, every way just. That which I have already mentioned shall serve for a Standard, and considering all the differences of the Goodness of
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this Road all the Year round, I found reason to make these Conclusions about it.

1. During one half of the Year, three Horses in a Waggon can only draw Two thousand Weight of Goods; and during the other half, Three thousand Weight; which amounts to Two thousand, five hundred Weight, all the Year round.

2. During the six Months of bad Road, the Horses can go only five Leagues in Twenty four Hours, so as to continue Working every Day as before; and during the other six Months, seven Leagues; that is, during every Working Day in the Year, they go six Leagues.

3. Horses employed on such Roads are not fit for Labour above five Years; that is, supposing them to begin to draw, as before, at the Age of five Years, and making the same Allowance for the two Years, in which they do easier Work, they are to be considered as fit to draw
a Wag-

a Waggon on an unpaved Road, seven Years.

4. Considering the frequent Accidents that Horses are liable to in drawing on bad Roads, one seventh Part of that Time will be found a very moderate Deduction upon that Account, so that the true Time that each Horse, at a Medium, is fit to draw upon Roads that are not paved, is to be stated only six Years.

XXIII. These Facts being taken for granted, as being what every ones Experience may convince him of, who has occasion to Travel in the *Low Countries*, especially in the Province of *Flanders*.

Let us suppose a Pavement of any determined Length ; as of Thirty Leagues, which Number being a Multiple both of Ten and Six, will serve us to avoid some Fractions which otherwise we must fall into. The whole Charge about this Pavement, by what has been already computed, is the
produce

produce of one Year of Nine thousand three hundred and ninety Acres of Land.

For the Conveniency of an easy and short Computation: Let all the Carriages perform'd on any Part of this Pavement, be not only in Waggon drawn by threeHorses, as before, but also, be equated to their respective Values in Carriages, from one End of the Pavement to the other; and let the whole Sum be that of twenty Waggon daily.

That this is a very moderate Supposition, any one may easily satisfy himself who considers a little the Road from *Paris* to *Orleans*, which is not a great deal different from the Example I have chosen. For he must observe, that at any Hour of the Day, there are many more Goods upon that Road, than are necessary to justify the Supposition that I have made; and that being the Case, it is perfectly the same Thing for my purpose, whether these Goods be supposed to go all the Way between these two Cities, or that they go

go only Part of the Way ; if by the Time they arrive at any given Place, other Carriages set out in such a Manner, as that every Day twenty Waggon drawn by three Horses, or what is equal to these, go ten Leagues on that Pavement.

These twenty Waggon drawn by sixty Horses, with twenty Men to attend them, will carry Yearly, twelve Millions Weight of Goods through the whole Length of the Pavement, and in twelve Years, that is, during the whole Time that Horses are fit for Labour, One hundred and Forty four millions.

XXIV. The Charge of the Carriage of all these Goods, being reduced to Land as before, is for all the Men, an hundred and eight Acres, and for all the Horses an hundred and thirty six Acres Yearly ; and the Charge for the twelve Years, amounts to the produce of Two thousand nine hundred and twenty eight Acres for one Year.

XXV. Let

XXV. Let the same Quantity of Goods be carried for thirty Leagues upon such an unpaved Road as has been described, in twelve Years time.

Each Waggon carrying only Two thousand five hundred Weight at a Time, and being five Days in going thirty Leagues, will carry in a Year's Time, only an Hundred and fifty thousand Pounds, or in twelve Years, a Million eight hundred thousand Pounds.

Therefore, to carry the whole Hundred and forty four Millions, there must be eighty Waggon, or just four Times as many as were required to carry the same quantity of Goods on a Pavement.

And the Charge of these eighty Waggon for twelve Years, being reduced, as before, amounts to the Produce of Eleven thousand, seven hundred and twelve Acres for one Year ; so that the Charge of the Carriage of these Goods on an unpaved Road, ex-

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ceeds

ceeds that on a Pavement by on Year's produce of Eight thousand, seven hundred and eighty four Acres, which comes but little short of the whole Charge of the Pavement.

XXVI. I have here considered the Difference of the Times of each sort of Carriages, as far as that Influences the Expence of them, without taking any Notice, that by saving Time, several sorts of Goods that either cannot be transported any great Length, or at least not without Danger of being damaged, on unpaved Roads, may be safely carried on Pavements. By the same Means likewise, the Advantage of a good Market, will often be obtained over those who have their Goods brought the same Distance on bad Roads. These two Articles, I am willing, however, to throw in *Gratis*, without desiring any Allowance to be made for them ; because it would engage me in too long a Discussion, to determine precisely, how far the Advantages

vantages a rising from thence would be carried.

XXVII. But there is one Consideration still behind, which I must not omit ; and for the Sake of which particularly I fixed on the Term of twelve Years in the Comparifon I am now making.

During twelve Years, only one Set of Horfes is imployed on a Pavement, which for the Reason above given we are to fuppofe three Years Old, when they begin to Work. During the three Years in which we fuppofe them to do no Work they require, at a Medium, an Acre of Ground, Yearly, to which adding the Ground neceffary for manuring this Land, and reducing the Whole as before ; the Whole will amount to one Year's produce of Two hundred and nineteen Acres.

On Roads not paved, Two hundred and forty Horfes must be imployed at a Time ; and of these there must be two compleat Sets in twelve Years ;

and consequently eight Times as many under three Years of Age are to be provided for during that Time, as of the former. This Charge amounts to a Year's produce of Seventeen hundred and fifty two Acres, so that meerly on this Account, Fifteen hundred and thirty three Acres are saved by a Pavement.

To this likewise might be added, the greater loss of Labour of Mares, while with Colt, which must still increase the Expence; but this and many other Things I pass over, that it may be plain how far I am from scrupulously insisting on all Advantages.

XXVIII. From this Comparison it appears, that meerly on the Score of the Carriage of Heavy Goods, the whole Charge of a Pavement between any two great Towns, or passing near considerable Places, even on a very moderate Supposition of domestic Trade, will be saved in less than eleven Years; for in twelve Years, the produce

duce of Ten thousand three hundred and seventeen Acres for one Year, is saved, which is Nine hundred and twenty seven Acres more than the whole Charge of the Pavement of thirty Leagues.

XXIX. Tho' the Observations on which the foregoing Calculation and Comparifon are founded, will not perhaps exactly agree to any particular Road in this Kingdom, that may be thought of Confequence enough to be paved ; yet the fame Proportions will hold, as I have ftated them ; and it was for this Reason, that as there are as yet no Pavements in *England*, I was obliged to found my Comparifon on Observations made in another Country, where the Strength of the Horfes that draw both upon paved and unpaved Roads, their way of Feeding and Working, and all other Particulars are the fame.

XXX. But

XXX. But before these Principles and Proportions can be applied to any particular Road, many Inquiries are necessary to be made about it; and when these have been carried a due Length, it will then be easy to determine, from all other Advantages, as well as from the Carriages, in how short a Time, the whole Charge of the Pavement will be saved; and likewise, what will be the most natural Proposal for putting such a Design in Execution; and from what Persons, a Fund may reasonably be expected for carrying it on. These in general are they who are most likely to share the Advantages of such a Pavement; but what Proportion of the first Expence each ought in Justice to bear; that is, how each Person's Advantages may be computed, and compared with one another, is not so easy to be determined without the help of other Principles than such as will probably offer themselves to those

those who confine their Views to High-Roads alone.

In Order to this, the whole Frame and Constitution of Society must be taken in, as it is found, in the Countries where these Roads lie ; and then each Man's particular Share in the Charge may be adjusted, by computing how much he is to be a Gainer by the Undertaking.

XXXI. As my Design in this Essay is not only to recommend the Advantages of paving some of the great Roads of this Kingdom, but also to give a General Idea, of what may be called a New *Political Arithmetic*, I have taken the Liberty oftner than Once, to refer the Explications and Proofs of several Things here mentioned, till I find a proper Opportunity of publishing, at least, some of the principal Parts of this Doctrine at full Length. And I must beg leave till then, to delay giving the particular Reasons, why I have chosen to express the Value of the Labour,

Labour, &c. here considered, in Land rather than in Money, which is by all Men looked upon to be the only certain Measure of the Value of every Thing else.

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